

EVALUATING THE GREEN SUPPLY CHAIN MANAGEMENT BARRIERS IN A SME: AN AHP APPROACH

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ABSTRACT

Over the last decade, Green Supply Chain Management (GSCM) has been in focus, as there has been lot of demand from environmental groups for optimization of resources in order to protect the environment. Hence, both the government as well as the consumers is more and more conscious about the implementation of ecological regulation to save environment. In order to do so, GSCM is a tool which needs to be implemented. There are certain enablers as barriers associated to the successful implementation of GSCM in any industry. The current research work deals with the study of 10 barriers faced during the implementation of GSCM in an SME. Further, analytical hierarchy processing (AHP) is used in order to sort and rank these barriers. The study is carried out at three different stages namely, finding the barriers, second defining the barriers and last ranking of barrier using AHP. The results obtained using the AHP model would help the decision makers in eliminating the various barriers on priority basis.

KEYWORDS: Green Supply Chain Management, SME, Barriers & AHP

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INTRODUCTION

Green Supply Chain Management (GSCM) practices provide all the gears, physical activity and knowledge essential to ensure effective and excellent control of an organization in the current scenario. It is very necessary to have a proper balance between the demand and supply. In order to achieve this, a proper optimization of resource is very necessary. A supply chain management, which can help the decision makers, achieves this while caring for the environment is called a Green Supply Chain Management. In short, a Green Supply Chain Management is one, which is environmentally conscious. A green supply chain takes into account all the environmental effects, right from the extraction of the raw material to the final disposal of the junk. A green supply chain integrates performance measures & environmental objectives with operational objectives and financial goals. Within the supply chain, each member motivates the other one to grow green consciousness, and guides them through proper information exchange and supplier's development programme. This integration in GSCM will result in minimized environmental effect and minimum waste while assuring maximum profit. In order to implement GSCM in a SME, the various barriers need to be identified and eliminated. The first step is to identify these barriers. These barriers are obtained by literature review, expert opinions and by visiting the concerned industry. A detailed literature review is carried out, in order to study the GSCM implementation, AHP approach and identification of GSCM barriers.

LITERATURE REVIEW

Kumara Swamy et al. [1] studied the barriers for implementing green supply chain Management (GSCM) practices on Organic irrigation. The researcher identified ten barriers, and their ranking was done using AHP. He came to the conclusion that the two major barriers for implementing GSCM in organic farming are lack of motivation & lack of knowledge about certification. Luthra et al. [2] studied the barriers faced in the Indian automobile industry while implementing the green supply chain management. The researchers identified eleven barriers to implement GSCM in Indian automobile industry. Interpretive Structural Modeling (ISM) methodology was used for finding contextual relationships among various barriers. Market Competition and Uncertainty; Lack of Implementing Green Practices; Cost Implications; Unawareness of Customers were identified as the top level barriers. Luthra et al. [3] proposed a GSCM method for enlightening ecological performance of procedures. Govindan et al. [4] identified forty seven barriers to implement GSCM in various industrial sectors. This was done using detailed literature survey, expert discussions and through a questionnaire based survey. The top notch barriers were identified using AHP which clearly indicated that the technology barrier category proved to be the leading barrier category. Jung [5] defined Green supply chain (GSC) as one of the “main efforts aiming to integrate environmental parameters (or requirements) with supply chain management systems.” Zhu et al. [6] clearly noted that various environmental issues such as solid waste disposal, global implications of air emissions, and natural resource usage need to be taken care of and regulated. It is here that GSCM practice becomes a vital issue. Ratna S. et al [7] used AHP for ranking manufacturing cells based on their lean performance in a SME while taking into account various parameters such as material flow, visual control and metrics. Beamon [8] suggested that green supply chain research should move from subjective studies towards an experimental and theory grounded approach. Hillary [9] classified the internal and external barriers to implementation of environmental initiatives in SMEs. Porter and Kramer [10] found that corporate social responsibility (CSR) has over the years emerged as a vital priority for every major and reputed firm in every country.

METHODOLOGY

The analytic hierarchy process (AHP) is basically step wise procedure for forming and analyzing complex results, based on arithmetic and mindset hierarchy. It was first used by Thomas L. Saaty in the 1970s and has found its use in various fields since then. The AHP method, also known as Eigen vector method provides the relative priorities of the factors and preserves ordinal preferences among the alternatives.

The computational steps for AHP are summarized as below.

Step 1: State the objective and the various attributes and construct the hierarchical structure.

Step 2: Specify judgments about the relative importance of each criterion in terms of its contribution to the achievement of the overall goal.

Step 3: To indicate a preference or priority for each decision alternative in terms of how it contributes to each criterion.

Step 4: A mathematical process is used to synthesize the information and provide a priority ranking of all alternatives in terms of their overall preference.

The pairwise comparison matrix is constructed using the table 1 below.

Table 1: AHP Standard Preference Table

Preference Level	Numerical Value
Equal Importance	1
Equally to Moderately	2
Moderate Importance	3
Moderately to Strong	4
Strong Importance	5
Strongly to very strong	6
Very strong Importance	7
Very strong to extremely	8
Extreme Importance	9

The Eigen value method can be used to calculate the Eigen vector for each pair matrix. The normalization the matrix of paired comparison and the calculation of attribute weights are done.

The list of the ten barriers to GSCM that have been identified are listed below.

- Lack of IT implementation (A)
- Lack of organizational motivation (B)
- Poor human resource quality(C)
- Lack of market for recycling (D)
- Cost implications (E)
- Lack of public consciousness (F)
- Lack of govt. support (G)
- Lack of corporate social responsibility (H)
- Competition in market and uncertainty (I)
- Lack of reverse logistics awareness (J)

A pairwise comparison of these barriers is done by the experts and is shown in table 2 below.

Table 2: Pair Wise Comparison Matrix

Barriers	A	B	C	D	E	F	G	H	I	J
A	1	3	7	1/5	1/3	9	7	3	5	3
B	1/4	1	5	3	1/5	7	9	1/3	1/9	3
C	1/7	1/5	1	7	3	1/8	1/9	5	9	1/5
D	5	1/3	1/7	1	1/9	1	1/5	1/5	1/3	9
E	3	5	1/3	9	1	5	1/7	3	7	5
F	1/9	1/7	8	1	1/5	1	9	1/3	1/5	1/7
G	1/7	1/9	9	5	7	1/9	1	5	1/7	9
H	1/3	3	1/5	5	1/3	3	1/5	1	1	7
I	1/5	9	1/9	3	1/7	5	7	1	1	1/3
J	1/3	1/3	5	1/9	1/5	7	1/9	1/7	3	1
Sum	10.512	23.12	35.78	34.311	12.52	38.2322	33.762	19.01	26.787	37.676

The first step is to normalize the column entries by dividing each entry by the sum of the respective columns. Then, we take the overall row average. The table 3 below shows the normalized column sum of the comparison matrix.

Table 3: Normalized Column Sum

Barriers	A	B	C	D	E	F	G	H	I	J	Priority
A	0.0951	0.1298	0.1956	0.0058	0.026	0.235	0.207334	0.158	0.187	0.080	1.451634
B	0.0238	0.0433	0.1397	0.0874	0.016	0.183	0.266572	0.017	0.004	0.080	0.946772
C	0.0135	0.0087	0.0279	0.2040	0.240	0.003	0.003258	0.263	0.336	0.005	1.214358
D	0.4756	0.0143	0.0040	0.0291	0.009	0.026	0.005924	0.011	0.012	0.239	0.908924
E	0.2854	0.2163	0.0093	0.2623	0.080	0.131	0.004206	0.158	0.261	0.133	1.694506
F	0.0106	0.0061	0.2236	0.0291	0.016	0.026	0.266572	0.017	0.007	0.004	0.666972
G	0.0135	0.0048	0.2515	0.1457	0.559	0.003	0.029619	0.263	0.005	0.239	1.665119
H	0.0317	0.1298	0.0056	0.1457	0.026	0.078	0.005924	0.053	0.037	0.186	0.768724
I	0.0190	0.3893	0.0031	0.0874	0.011	0.131	0.207334	0.053	0.037	0.009	1.042134
J	0.0317	0.0144	0.1397	0.0032	0.016	0.183	0.003258	0.007	0.112	0.027	0.591258
Sum	1	1	1	1	1	1	1	1	1	1	

The last column in the table 3 above is the row sum of all the ten rows that is the ten barriers coded as A, B, C, D...J. Based on the row sum obtained in the table 3, the ten barriers to the successful implementation of GSCM in an SME can be listed as below in table 4.

Table 4: Barrier Priority

Barrier	Priority
1. Cost implications ;E	1.694506
2. Lack of govt. support; G	1.665119
3. Lack of IT implementation ; A	1.451634
4. Poor human resource quality ; C	1.214358
5. Competition in market and uncertainty ; I	1.042134
6. Lack of organizational motivation ; B	0.946772
7. Lack of market for recycling ; D	0.908924
8. Lack of corporate social responsibility ; H	0.768724
9. Lack of public consciousness ; F	0.666972
10. Lack of reverse logistics ; J	0.591258

RESULTS AND CONCLUSIONS

The current research work deals with the sorting and ranking of various barriers causing hindrance in the successful implementation of GSCM in a SME. Analytical Hierarchy Processing is used as the tool to find out the factors which are most influencing in the implementation of GSCM. The priority is given to each of the ten barriers and they are clearly indicated as in the table 4 above. It can be clearly concluded that, cost implications with a priority of 1.694506 is the major barrier faced during the implementation of green supply chain philosophy. Also, lack of govt. support comes a close second as a barrier. The concerned authorities need to take care of these barriers in order to keep pace with the global competition while caring for the nature and reducing the carbon footprint.

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